

**The South African Species of *Nemopalpus*  
(Diptera : Psychodidae).**

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With 27 Text-figures.

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I. INTRODUCTION.

THE psychodid subfamily Bruchomyiinae includes three genera of forest-dwelling flies, *Bruchomyia* Alexander, *Nemopalpus* Macquart and the recently described *Eutonnoiria* Alexander. The first two of these have been subjects of much discussion, mainly because their morphology is that of a very archaic type, with features alleged to be annectent between two primitive families, Psychodidae and Tanyderidae.<sup>1</sup> Alexander (1928) gives an account of the quite complex taxonomic history of the group, and in further papers (1929, 1940) provides additional information. Crampton (1925, 1926) discusses the thoracic structure and its significance. Fairchild (1952) gives a catalogue of species of *Nemopalpus* and *Bruchomyia*, and redescrptions of many of the Neotropical species with excellent figures and descriptions of the genitalia.

*Nemopalpus* is especially interesting because of its wide but discontinuous distribution in the Old and New Worlds, and the occurrence of two fossil species in Oligocene Baltic Amber. Only one species has so far been described from the Ethiopian Region, *Nemopalpus capensis* Edwards (1929), based on a damaged male from Pondoland. This species is little known, there being only two subsequent references to it. Theodor (1948, p. 96) commented on the absence of buccal armature in the female, but did not describe his material further.<sup>2</sup> Stuckenberg (1955) recorded *capensis* from a forest near Kranskop in Natal, and noted the 16-segmented antenna as being typical of the genus. Since 1955 more material of *Nemopalpus* has been obtained from other forests

<sup>1</sup> Hennig (1960, p. 278) considers the resemblances between *Nemopalpus* and the Tanyderidae to involve only plesiomorphic characters, and hence not to be significant.

<sup>2</sup> Professor Theodor has informed me that he found a single specimen of *capensis* among *Phlebotomus* received from the British Museum (see under that species).

in Natal and the Eastern Transvaal, and an old series has been discovered in the Durban Museum. A recent examination of this material revealed that all Natal specimens are conspecific with *capensis*, and that those from the Transvaal represent a new species, described below as *transvaalensis*, which forms a species-pair with *capensis*. These species have in common a distinctive yellowish-brown coloration and a pattern of dark hair-clusters on the wing, and differ from other species of the genus in having basal spurs on veins *R*5 and *M*2. In *transvaalensis* (text-fig. 1) the venation is more primitive than in *capensis*; there is an appendix at the base of *R*2+3, a complete *m* cross-vein is present in four of the seven available specimens, and in at least one of the remaining three specimens an incomplete *m* is visible after staining. According to Hennig (1954) the Psychodidae are apomorphous in lacking *m*; if this is correct, it appears that *Nemopalpus transvaalensis* is the first member of its family known to have a discal cell.

A further new species has been collected at Port St. Johns, the type locality of *capensis*. It differs markedly from the *capensis-transvaalensis* pair in colouring, lack of wing spots, venation (which is like that of the genotype, *flavus* Macquart, as figured by Jung, 1958), and structure of the genitalia in both sexes, and is described below as *Nemopalpus concolor* n. sp.

These two new species increase the number known to 21. The species are distributed as follows (based on Fairchild, op. cit.): a Central American endem-centre with six species, including one (*antillarum* Fairchild) on Hispaniola; an endem-centre in Southern Brazil, Argentina and Paraguay, with five species; one species, *flavus*, in the Canary Islands; two fossil species in Baltic Amber; three species in South Africa; two Oriental species, one in Malaya, the other in Borneo; and two Australasian species, one in New South Wales, one on both islands of New Zealand. Fairchild (op. cit.) says "the group is world-wide in distribution within the tropics, only the fossil species being extra-tropical", but that is not quite correct as the species of the Southern Hemisphere are extra-tropical and so is *flavus* in the Northern Hemisphere. Edwards (in Tonnoir, 1929, p. 3; accepted by Hennig, 1960, p. 279) states, "*Nemopalpus* apparently has its present centre in tropical South America . . .", but that cannot be so in view of the way the species divide into New and Old World groups, the latter group having the more primitive venation and male genitalia (see below). The New World group seems to be monophyletic, and derived from an ancestral form which came from the palaeotropics.

The distribution pattern of *Nemopalpus* is curiously disjunct. One of its most striking features is that only four of the 19 living species are on islands (*antillarum* on Hispaniola, *unicolor* Edwards on Borneo, *flavus* on the Canaries, and *zelandiae* Alexander on New Zealand). The islands on which they occur are not of recent origin; Borneo is continental and was connected with Malaya, Sumatra and Java in the Pleistocene; Hispaniola, though old, apparently is not continental but complexly volcanic; New Zealand is an old continental

island ; and the Canaries, though volcanic, appear also to be of considerable age (Darlington, 1957, Chapter 8). The presence of a species on the Canary Islands is unexpected, as these islands are not an important refuge for relict Diptera (see Frey, 1936). An apparent relict might seem to be the genus *Lampromyia* Macquart (Rhagionidae), which is analogous to *Nemopalpus* in its disjunct distribution in the Canary Islands and Southern Africa (occurring as well in the countries around the western end of the Mediterranean ; Stuckenberg, 1960). However, even though these two genera have this feature common to their distribution patterns, it seems that their presence in these islands is a consequence of two completely different events. *Lampromyia* is quite likely to have been acquired by chance immigration across the sea barrier separating the Canaries from the area occupied at present by this genus in North Africa, the direction of the prevailing winds being suitable for such an accidental transportation. *Nemopalpus flavus*, on the other hand, is geographically remote from the South African, Oriental and Baltic endem-centres. Probably its ancestral form arrived in the islands as a chance immigrant from Africa or Southern Europe at a time when forest was extensive, possibly during the Miocene or Oligocene. Its morphology shows it to belong to the group of Old World species (see below) and so it was not derived from the Neotropical Region. At all events, the preservation of *flavus* or its ancestral form in so unlikely a place as the Canaries can have been no more than an improbable accident.

The distribution of the continental species of *Nemopalpus* does not coincide well with the distribution of suitable habitat. This seems to suggest that present conditions do not favour the spread of species, at least in the Old World, and that these species, or their ancestral forms, achieved their distribution a long time ago and are now unable to alter it. In the Old World the genus seems to have become confined to old forest refuges in unglaciated, topographically stable regions. The Amber fossils of course indicate a formerly much wider range. The distribution of species in the New World I am not competent to discuss. The only island species of this region, *antillarum* of Hispaniola, is stated by Fairchild to be closest to *mopani* de Leon, of Guatemala and Mexico, which is consistent with Darlington's (loc. cit.) view that the fauna of the Greater Antilles is derived from Central America. Otherwise I can note only that the distribution of *Nemopalpus* in the Neotropical Region is very like that of Blepharoceridae (see Alexander, 1958), an evidently long-established and rather isolated family usually occurring in physiographically old parts of the earth.

A comparison of the distribution of *Nemopalpus* with that of some other archaic groups of Diptera reveals some interesting contrasts. For example, the Anisopodid genus *Olbiogaster* Osten-Sacken, has a similarly wide, discontinuous range, has the same number of living species (19), all of which are silvicolous, and has some old fossils (? correctly) assigned to it. According to

Edwards (1928) the species fall into two groups, Palaeotropical and New World, on a venational character. The species are distributed as follows: in the New World, Peru, Costa Rica, Puerto Rico, Mexico, Brazil, Paraguay, Trinidad; in the Old World, West Africa, San Thomé, Congo Republic, Madagascar, Ceylon (two species), Formosa, Japan and Lord Howe Island. There are three fossils, one from Eocene in Colorado, one from Lias in Mecklenburg, the third from Jurassic in England. No less than nine of the living species are island-dwellers; of the islands on which they occur, six are continental, two volcanic and oceanic (Puerto Rico, Lord Howe Island). Nearly all the species of *Olbiogaster* are within the Tropics or very close to them, the only extra-tropical living species being those on Lord Howe Island and Japan. The only continental species of the Old World are in the forests of West Africa and the Congo. Generally speaking, it seems that *Olbiogaster* is distributed in areas of old, permanent forest but, despite its wide range, does not overlap with *Nemopalpus* except in Costa Rica, southern Brazil and Paraguay; whether this is real or due to inadequate collecting is an open question.

A further example is the anisopodid genus *Mesochria* Enderlein. This is confined to the Old World, and its eight described species, all silvicolous, are distributed in the Gold Coast, Congo Republic, Madagascar (two species), Seychelles, Borneo, Java and Samoa. All are tropical, and six inhabit islands. All the islands concerned, except Samoa, are continental. *Mesochria* is thus palaeotropical, and survives mainly in old forest refuges; it reached Samoa at the last stage of its expansion. The eight species are known from only nine specimens, and thus really seem to be rare. If the pattern outlined above approximates to the actual one, it seems that withdrawals and extinctions must have taken place. As yet, *Mesochria* and *Nemopalpus* are known to be precinctive only in Borneo, and the former has more in common with *Olbiogaster* as regards distribution.

These three genera have several features in common; they are archaic types, all are forest-dwellers, their distribution is disjunct, and they seem to be confined mainly to areas with long-established forest. *Olbiogaster* and *Mesochria* have a high proportion of species on islands, which may indicate that continental regions, with their greater diversity and evolutionary pressure, are less favourable. Why *Nemopalpus* has not been confined to the same forest refuges in the Old World as *Olbiogaster* and *Mesochria* is impossible to say; it may have been a result of ecological preferences, or a dispersal of these genera at different times.

Fairchild (op. cit.) has pointed out that the species of *Nemopalpus* fall into two groups: an Old World group, including the fossil species, characterized by  $R_2$  being longer than or equal to  $R_2+3$ , and by the more simple male genitalia, parameres being lacking (at least in the species adequately described); a New World group in which there are complex, often bizarre, parameres on the basistyles, and, in all but two species,  $R_2+3$  is much longer than  $R_2$ . The

South African species are typical members of the Old World group, and *flavus* of the Canary Islands, recently redescribed by Jung (1958), is clearly also of this group. An additional feature of at least some of the Old World species is the arrangement of the genital forceps. In the South African species and *flavus*, the basistyles are inclined toward the proctiger (*i.e.*, ventrally) and the dististyles are directed upwards (text-figs. 7-9; Jung, *op. cit.*, figs. 6-9); whereas, in the New World species, the basistyle is inclined away from the proctiger, and the dististyles are directed downwards (Fairchild, figs. 1, 14). A further difference which may prove constant is the considerable length of the ninth tergite in the male sex of the New World species, the proctiger exceeding the apex of the aedeagus and sometimes even the dististyles; in the South African species and *flavus* this tergite is very much shorter (text-fig. 7, t.9). The female genitalia of the South African species seem very different to those of the Neotropical *N. arroyi* and *N. dampfianus* as figured by Fairchild. In fact, there seems to be a greater resemblance to *Bruchomyia fusca* and *B. shannoni* (Fairchild, figs. 46, 53).

The monotypic Ruwenzori genus, *Eutonnoiria*, resembles *Bruchomyia* (in which its one species was originally placed) and the Neotropical *Nemopalpus*, in having the basistyle inclined upwards away from the proctiger and the ninth tergite elongate (Tonnoir, 1939, figs. 6, 7), but is more primitive in the lack of parameres and in the general simplicity of the genitalia. Alexander (1940) regards the abnormally high number of 113 antennal segments as primitive, but it seems to me that this is not certainly so. In *Bruchomyia* the number of segments varies from 26 to 31, and is not always constant in a species (Fairchild records 26-29 segments in *B. shannoni*), and in one species, *B. fusca* (Fairchild, pp. 277-278), the antennae of a single specimen may be unequal as regards the length of certain flagellar segments and the development of incomplete joints partially dividing some of the segments. There seems to be a genetic trend towards multiplication of antennal segments in *Bruchomyia*, and, as Fairchild suggests, probably one has been operative also in the stock from which *Eutonnoiria* evolved. That these genera are related more to one another than the latter is to *Nemopalpus*, is indicated by their having this apomorphous character in common. A long distal section to vein *Cu*<sub>1</sub>, a feature of *Bruchomyia* and *Eutonnoiria*, cannot be proposed as an indicator of a close relationship between these genera as it is relatively a primitive character.

Authors have commented that the species of *Nemopalpus* are very rare, though Fairchild observes, "they will probably be found to be fairly abundant when searched for carefully in suitable habitats. The adults seem to prefer dark and humid places, such as hollow trees, the crevices between buttressed roots of large trees, rock crevices, etc., as daytime resting places and they are often taken in association with *Phlebotomus*". I have found the South African species to be common during their period of adult life in a particular locality. Nearly all the material of *transvaalensis* and *capensis* that I have collected has

been obtained during overcast weather while rain was falling or shortly after there had been a downpour, when the forests were gloomy, dripping and rather cold. In these circumstances the flies were very active, and flew about in a steady, direct manner a few feet above the forest floor, their coloration making them conspicuous against the dark, wet foliage. The series of *capensis* from the Karkloof was taken at about 11 a.m. on a sunny morning following a day of phenomenally heavy rains. No specimens of *concolor* were observed in flight; all were collected while resting on shaded tree trunks, up to about 6 ft. above ground level, after their presence had been accidentally discovered. At the time the weather was fine, and had been for several days previously.

All three South African species are known only from indigenous forest in regions of fairly high rainfall (+40 to +50 in. p. a.), at altitudes mostly between 3,000 ft. and 5,000 ft. The series of *capensis* from Durban was collected at only a few hundred feet above sea level (it is noticeably shorter in wing length, see below), in extensive forest that used to exist in what were the outskirts of the city in 1919; this forest has since almost completely disappeared (L. Bevis, personal communication). Possibly further species of *Nemopalpus* remain undetected in the Knysna forest area, and perhaps even in forest residuals in the South-West Cape though this does not seem likely in view of the extensive collecting already done there. However, it may prove to be that *Nemopalpus* is confined to forests in the eastern half of South Africa, as there are other more or less relict groups that have such a distribution. An example is the Onychophoran genus *Opisthopatus* Purcell, which has its northern limit at Mariepskop in the Eastern Transvaal, and ranges south to the Uitenhage district near Algoa Bay (Brinck, 1957).

## II. KEY TO THE SOUTH AFRICAN SPECIES.

1. Colouring distinctly yellowish, wings spotted by clusters of dark hairs; female with short, dark, lanceolate erectile hairs among normal hairs on abdominal tergites 2
- Colouring uniformly brownish, wing immaculate; dististyle with an apical row of broadly subtriangular teeth; female abdomen without specialized hairs; spermathecal duct heavily sclerotized along entire length, spermatheca containing a dark, sclerotized structure into which duct opens (Pondoland)
2. Basal spur present on  $R2+3$ ; clusters of dark hairs absent at ends of all radial veins and  $M1$  (Eastern Transvaal) *concolor* n. sp.
- $R2+3$  without basal spur; ends of most radial veins and all median veins with distinct spots (Natal and Pondoland) *transvaalensis* n. sp.
- $R2+3$  without basal spur; ends of most radial veins and all median veins with distinct spots (Natal and Pondoland) *capensis* Edwards

## III. DESCRIPTIONS OF SPECIES.

*Nemopalpus capensis* Edwards, 1929. Text-figs. 4, 7, 10, 11, 18–22.

*Nemopalpus capensis* Edwards, 1929, *Ann. Mag. nat. Hist.*, (10) 3: 421–423, figs.; Theodor, 1948, *Bull. ent. Res.*, 39: 96 (reference to absence of buccal armature in ♀); Fairchild, 1952, *Ann. ent. Soc. Amer.*, 45 (2): 261 (catalogue of species); Stuckenberg, 1955, *Ent. mon. Mag.*, (4) 91, No. 183: 87 (recorded from Kranskop, Natal).

Type locality : Port St Johns, Pondoland. Type in British Museum (Nat. Hist.), London.

*Diagnostic characters*.—A conspicuous, yellowish-brown species with obviously spotted wings, the spots being clusters of dark hairs ; veins *R5* and *M2* with basal spur, *M1* and *M2* forked basad of *r-m*, *m* absent, base of *R2+3* without spur ; female with modified hairs (text-figs. 16, 17) on abdominal tergites, mixed with normal hairs ; dististyle of male genitalia as in text-fig. 7, usually with a flange on upper flexor edge ; spermatheca a large, simple sac (text-fig. 22) ; spermathecal duct modified at apex into a heavily sclerotized, tubular rod (text-figs. 18–20, *spe*).

*Description* (♂♀).—Eyes black in pinned specimens, separated at narrowest part of frons by about  $1\frac{1}{2}$  diameters of one facet ; frons long, narrow, bearing a crest of erect hairs which merges with longer hairs on vertex and occiput. Sixteen antennal segments present, basal two very short, stout (text-fig. 10) ; flagellar segments (except basal one) darkened basally, usually not more than basal third on segments 2–4, about basal half on others, but in a few specimens nearly all flagellar segments darkened on basal half or nearly basal half ; flagellar segments cylindrical, their lengths in the following ratio :  $40 : 23\frac{1}{2} : 21 : 20 : 19 : 16\frac{1}{2} : 16 : 15 : 15 : 13 : 12 : 11\frac{1}{2} : 10 : 12$  ; terminal segment very much as in text-fig. 14, shaped like a short-necked bottle, terminal part knob-like, slightly constricted basally, with two collars of minute, very refractile setulae ; ascoids very few, mounted antenna of a ♂ shows a discoidal (text-fig. 15) near apex of flagellar segment No. 1, two subapical discoidals on No. 2, two disto-median discoidals on No. 3, one (? or two) on No. 4, one on No. 5, none visible on No. 6, two discoidals on Nos. 7–13 (text-fig. 11), and possibly one on No. 14 ; no other type of ascoid observed. Mouthparts shorter than vertical diameter of head ; labella with long hairs ; palps with usual five segments, basal one very short, annular, remainder in ratio,  $15 : 18\frac{1}{2} : 18 : 42$ , apical one whip-like and slender, third stouter than others, second and third segments with abundant brownish hair, fourth and fifth with finer, pale yellowish shining hairs ; Newstead's scales apparently absent. Face with fan of brownish hairs.

Thorax generally light brownish tinged with yellow. Mesonotum in well-preserved specimens with well-defined, light buff yellow pruinose pattern, as follows : a straight-edged median stripe, widest anteriorly, posteriorly becoming indefinite and merging into a prescutellar pruinose patch ; two lateral longitudinal pruinose vittae which fade out anteriorly just before calli, posteriorly merging with median pruinose stripe. Mesonotal hairs long, abundant, pale yellowish, arranged in relation to pruinose areas as follows : pruinose areas almost devoid of hairs, median one with a narrow strip of acrostichal hairs in mid-line (usually a double row), expanding anteriorly into a group of hairs on mesonotal hump ; laterally an extensive posthumeral tuft merges into dorsocentral strip of hairs between pruinose areas, the two dorsocentral strips

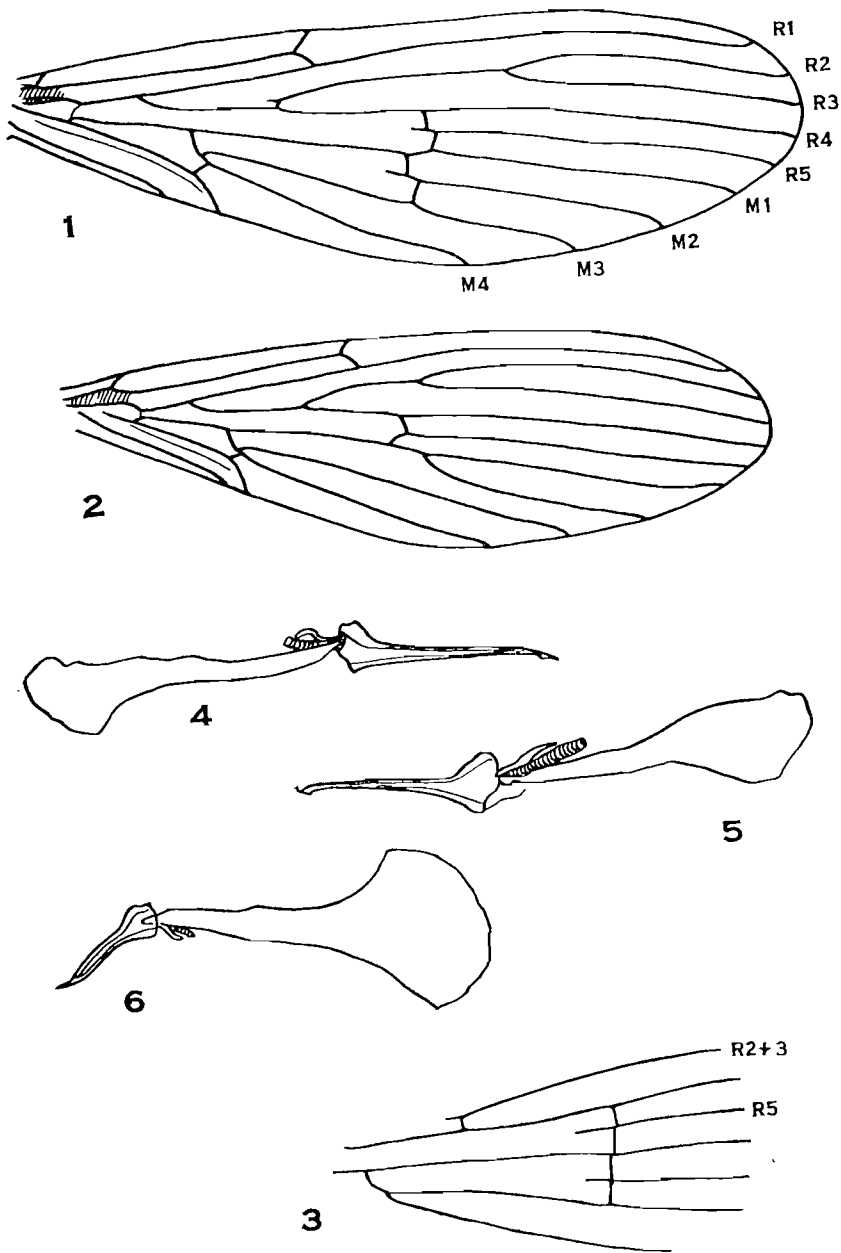
merging before scutellum ; a restricted supra-alar tuft of hairs ; a posterolateral tuft on upper surface of posterior alar lobe ; supra-alar declivity bare ; haired zones appear darker in certain lights because of numerous hair sockets breaking up the surface. Humeral calli unhaired, very thinly pruinose. Posterior alar lobes and scutellum thinly pruinose, with greyish, frosted appearance (best seen in oblique lighting). Pleura of same colour as mesonotum, sternopleuron usually slightly darkened, sometimes a poorly-defined, dark, horizontal line on hypopleuron ; pleura almost entirely without hairs, small tuft present before prothoracic spiracle. Scutellum with marginal fringe of long hairs. Coxae haired except on anterolateral face of fore coxa ; legs densely clothed with recumbent, shining, yellowish brown hairs ; tibiae, and all tarsomeres except apical two, with erect, shining, pale yellowish bristles. Halteres yellowish with shining, yellowish hairs on knob, stem paler.

Wings with abundant, shining, pale yellowish hairs, marginal fringe long, especially on anal lobe, squama with tuft of very long hairs. A distinctive pattern of dark spots present (see Edwards's figure), each spot a cluster of dark hairs, arranged as follows : a cluster at end of each longitudinal vein, except *R*4 at apex of wing, absent in some specimens from ends of *R*3 and *R*5 (in Edwards's figure they are absent also from ends *R*2 and *M*1, but this has not been observed in available material) ; these clusters on perimeter of wing decrease in size towards tip, those at ends of *R*3 and *R*5 small when present ; two large, adjacent clusters at bases of *R*5 and *M*2, a cluster at fork of *R*2 and *R*3, at arculus, at fork of *M*3 and *M*4, at mid-length of *R*5, and at apex of *Sc*. Venation as in text-fig. 1, except that *m* and basal spur on *R*2+3 are missing (see Edwards, loc. cit.) ; basal spurs present on *R*5 and *M*2, *M*1 and *M*2 forking before *r-m*, fork of *R*2 and *R*3 deep, *R*2 longer than *R*2+3.

Abdomen mostly same colour as thorax, sometimes with dark, irregular areas due to drying of body contents ; apical segments and genitalia more brownish. Each tergite and sternite divided into two narrow, transverse, sclerotized bands to which abdominal hairs are confined (text-figs, 16, 18), basal band almost twice width of apical one ; abdominal hairs long, pale yellowish suberect, on each segment in two transverse zones, there being quite wide hairless intersegmental areas that emphasize the otherwise inconspicuous segmentation of abdomen. In ♀ the tergites bear modified, erectile hairs scattered among the normal ones (text-fig. 16) ; these hairs lanceolate with thin basal stalk, noticeably darker and much shorter than normal hairs, with numerous, irregular dark inclusions in dehydrated, macerated specimens (text-fig. 17).

Male genitalia (text-figs. 4, 7) of usual inverted type ; ninth sternite (*st.* 9). curved both downwards and transversely, thickly beset with hairs ; ninth tergite (*t.* 9) narrow, with a thick brush of hairs ; basistyles in form of long, narrow arms, simple in shape, narrowed near apex ; dististyle (inset in text-fig. 7) directed upwards (*i.e.*, away from proctiger), a flat blade, with a flange along





TEXT-FIGS. 1-6.

Wing venation of *Nemopalpus transvaalensis* (1, 3) and *N. concolor* (2); internal aedeagal sclerites of *N. capensis* (4), *N. transvaalensis* (5) and *N. concolor* (6) (note that in fig. 6 this structure is inverted in relation to figs. 4 and 5).

upper flexor margin bearing a number of fine hairs, this flange variably developed, reduced in a specimen from Umbilo, not clearly shown in Edwards's figure of the type; apex of dististyle apparently has a very compact group of minute, stout, very refractile setulae (details difficult to discern); on lower inner face of dististyle are many fairly long hairs. Aedeagus (text-fig. 7, *ad*) elongate triangular, its apex slightly exceeding end of basistyle; internal aedeagal sclerites as in text-fig. 4, basal apodeme moderately dilated, distal shaft with long, slender, tapering point; efferent ducts uniting in a short tube entering cephalic end of distal shaft.<sup>1</sup>

Female genitalia (text-figs. 18–22) complex; eighth sternite and tergite fused into a narrow, annular sclerite supporting lobes of oviscapit (*vbt*); ninth tergite fully formed, densely haired, its lower corners curled inwards and bearing a fairly dense brush of hairs which are shorter and slightly stouter than other abdominal hairs; tenth tergite completely divided by a median, wedge-shaped, longitudinal membranous strip, and curving downwards strongly. Below ninth and tenth tergites is an extensive membrane, differentiated into two prominent, partly bilobed depressions (*pf*); these depressions curve inwards towards body cavity, except at caudal ends where their surface curves out and over to make a slight ridge, in section the profile being as in text-fig. 21; the depressions more sclerotized than surrounding membrane. their boundaries sharply defined, their outer surface densely lined with very fine, minute hairs. Each depression connected basally to a sclerotized bar, the two bars joined at median ends to a deeply arched sclerite (text-fig. 20); attached across end of this arched sclerite is a flat, subpyriform apodeme shaped as shown in text-fig. 20 (*vp*), posterior end of this apodeme broadly V-shaped and bounding an irregular, suboval opening; attached to this opening, dorsad to posterior end of plate, is apex of spermathecal duct (text-fig. 20, *spe*). Spermatheca (text-fig. 22) is a large, simple, membranous sac reaching at least to basal margin of segment 5; duct leaves posterior end as a short, simple tube, then making an oblique join with a dark, heavily sclerotized, rod-like tube (text-fig. 19) which is a modified portion of the duct.

Length of wing: ♂ (excluding specimens from Umbilo), 4.8–5.2 mm.; ♂, Umbilo series, 4.12–4.7 mm.; ♀, 5.2 mm.

*Material examined.*—Forest 7 miles east of Kranskop, Natal, 10.xi.1954, 3 ♂, 2 ♀ (recorded by Stuckenberg, op. cit.; other specimens from this series have been dispersed to various Museums); Town Bush, Pietermaritzburg, Natal, xi.1959, 5 ♂, 1 ♀; Karkloof Forest at Geikie's Farm, Natal, i.1957, 7 ♂ (all the aforementioned material in Natal Museum, *B. R. Stuckenberg* leg.); Umbilo, Durban, Natal, 7.x.1919, 5 ♂, 29.ix.1919, 3 ♂ (*L. Bevis* leg.), in

<sup>1</sup> Length of distal rod and basal apodeme in ratio 11:16. In Edwards's figure they are shown as being the same length; Dr. P. Freeman has kindly examined the type and confirms that the drawing is exact; probably the dilated end of the basal apodeme was cut off when the tip of the abdomen was removed.

Durban Museum, except 3 specimens donated to Natal Museum (the ♀ referred to by Theodor is from this series).

*Nemopalpus transvaalensis* n. sp. Text-figs. 1, 3, 5, 8, 16, 17.

*Diagnostic characters*.—Very close to *capensis*, also a light yellowish brown species with abundant, pale yellowish hair and spotted wings, differing as follows: *R2+3* with short basal spur; *m* cross-vein (and hence discal cell) present in some specimens, rudimentary in others; spots on wings, formed by clusters of dark hairs, much fewer, smaller and paler, absent from ends of all radial veins and *M1*; male genitalia (text-fig. 8) differing in shape and vestiture of dististyles.

*Description*.—So similar to *capensis* that only differences need be noted. Flagellar segments of antennae almost entirely brownish, only a short, apical portion pale yellowish. Sternopleuron frequently with a dark, horizontal mark opposite attachment of fore coxa. Modified hairs on tergites of ♀ abdomen (text-fig. 16) very dark, more numerous on posterior sclerotized strip. Wings more thinly haired, hairs very pale, shining yellow; spots formed by clusters of dark hairs are fewer, paler and smaller, absent from ends of all radial veins and *M1*, those at ends of *M2-M4* small and very inconspicuous. Base of *R2+3* (text-figs. 1, 3) always with short spur; in four of seven available specimens *m* cross-vein present (text-fig. 1), forming a discal cell; a wing of one of remaining specimens shows a rudimentary *m* after staining; *M1* and *M2* fork basad of *r-m*, in one specimen (text-fig. 3) basal part of *R5*, *r-m*, basal part of *M2*, and *m* all almost in one line.

Male genitalia shown in text-figs. 6, 8; differing from *capensis* in having aedeagus proportionately shorter and broader, its apex not exceeding dististyles in the one specimen dissected; basistyles larger; dististyles simpler, being flat, slightly recurved blades without flange on inner edge, with much fewer setae, no long hairs on inner face, and on apex a tightly-packed group of about six short, stout setulae (inset in text-fig. 8); internal aedeagal sclerites (text-fig. 5) very similar to those of *capensis* (text-fig. 4).

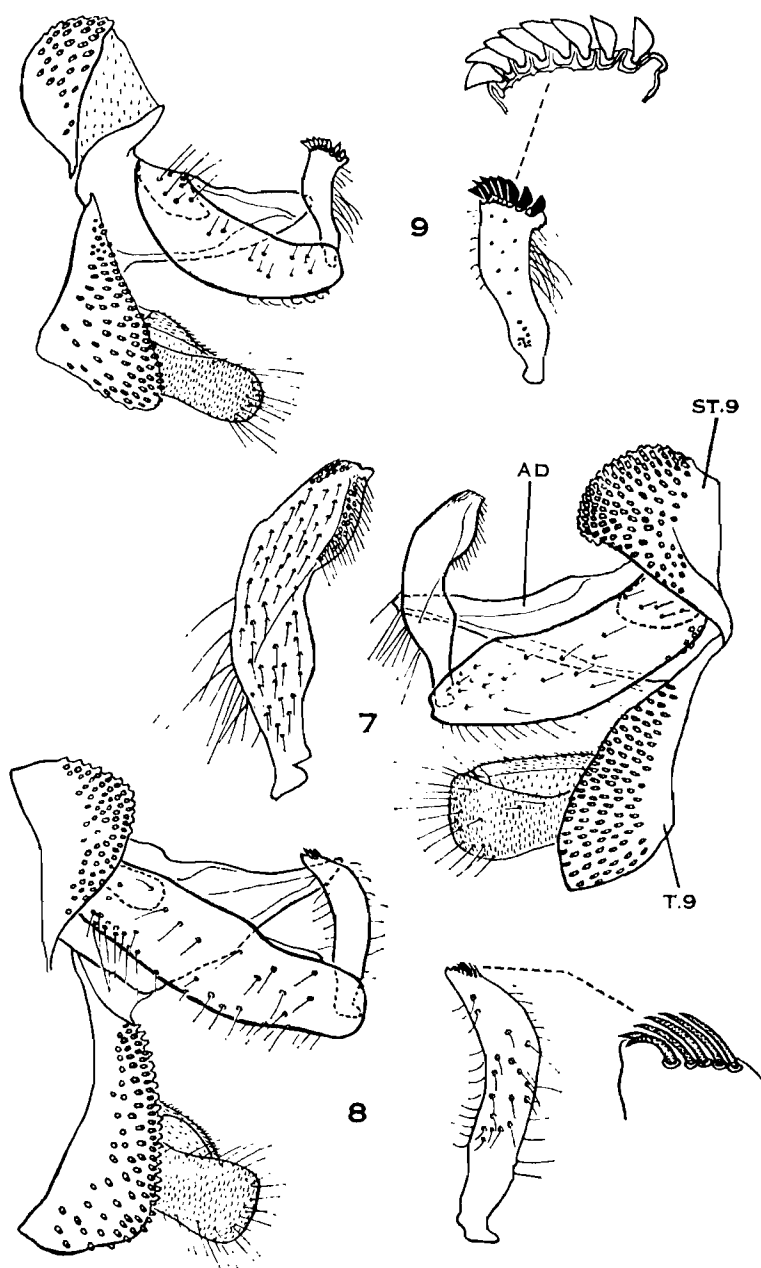
Female genitalia very much as in *capensis*, differing only in minor details of shape.

Length of wing: ♂, 4.95–5.5 mm.; ♀, 5.1–6.0 mm.

*Material examined*.—Holotype ♂, allotype, 1 ♂, 4 ♀ paratopotypes, from indigenous forest at Mariepskop, Pilgrims Rest District, Eastern Transvaal, x. 1956 (*B. R. Stuckenberg* leg.); in Natal Museum (N.M. No. 799), one specimen donated to British Museum (N.H.). The type locality is a Forestry Reserve on the Transvaal Drakensberg, at the headwaters of the Klaserie River.

*Nemopalpus concolor* n. sp. Text-figs. 2, 6, 9, 12–15, 23–27.

*Diagnostic characters*.—A plain, light brownish, unicolorous species with unspotted wings; venation as in text-fig. 2, no basal spurs on radial and



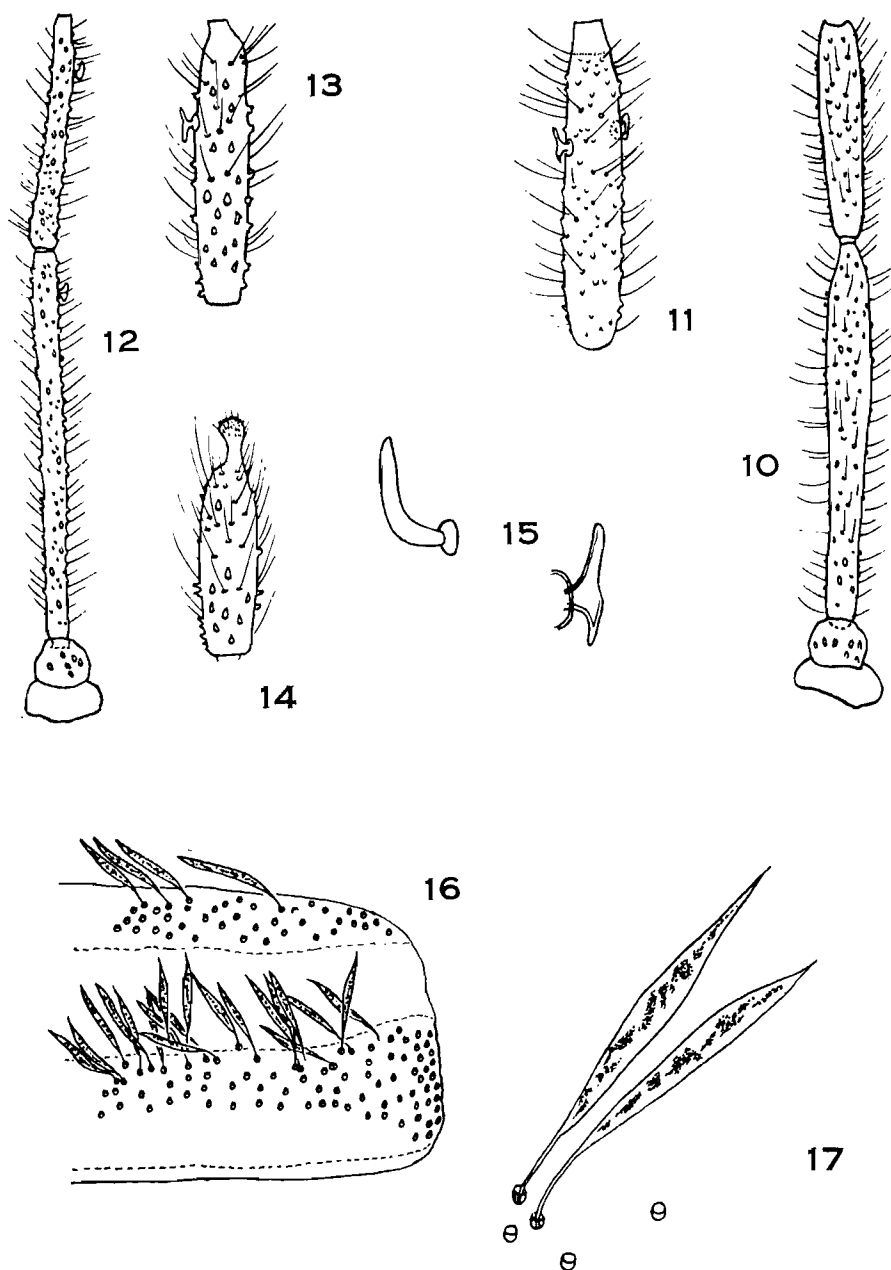
TEXT-FIGS. 7-9.

Male genitalia of *Nemopalpus capensis* (7), *N. transvaalensis* (8) and *N. concolor* (9); the dististyle in each case is shown enlarged, and in figs. 8 and 9 the apex of the dististyle is inset with further enlargement.

median veins, *M*1 and *M*2 forking apicad of *r-m*, fork of *R*2 and *R*3 very deep, *R*2 about  $2\frac{1}{2}$  times *R*2+3; abdomen without modified hairs, or secondary structural adaptations of the pregenital sclerites, in both sexes; dististyle (text-fig. 9) widened apically, topped by a row of about eight subtriangular teeth; spermatheca (text-figs. 23, 26, 27) a large sac, enclosing at caudal end a peculiar, irregular, dark structure into which spermathecal duct opens; duct (text-fig. 23) long, dark, well sclerotised along entire length.

*Description* (♂ ♀).—All hairs, unless otherwise described, are very pale yellowish, almost straw-coloured, but flight brownish at low magnification. Eyes black in pinned specimens. Head light brownish tinged with yellow. Frons short, narrow, its smaller width equal to about two eye facets; it has a crest of erect hairs, this usually slightly separated from occipital hairs which are long, numerous, erect. Face with thin brush of forwardly-directed hairs. Mouthparts shorter than vertical diameter of head, labella with short hairs. Antennae unicolorous light brown, joints paler, abundant short hairs and numerous longer ones present; 16 segments present, scape and pedicel (text-fig. 12) very short, stout, subannular; flagellar segments cylindrical, almost of equal width throughout, decreasing in length according to following ratio: 42:25:23:19½:19:17:16:14½:14:13:11:10½:10½:11; apical segment (text-fig. 14) skittle-shaped, with small, knob-like apex bearing minute hairs. Ascoids not seen on apical and penultimate segments, present on other segments as follows: one discoidal, subapical on basal flagellar segments, becoming disto-median on others, on flagellar segments 1–12 (in one specimen a second discoidal seen on opposite face on a few segments), and a few “spinose” ascoids (text-fig. 15) observed on flagellar segments 3 and 7. Palps with normal five segments; basal segment very short, subannular, next three segments subequal in thickness but increasing in length, apical segment long, thin, whip-like; lengths of palpal segments (except basal) in ratio 9:14:19:38; Newstead’s scales apparently absent.

Humeral calli pale brownish yellow. Mesonotum with abundant erect hairs and three greyish yellow pruinose stripes, a median stripe of more or less equal width throughout, extending over hump anteriorly, and a lateral one on each side, the two laterals merging in a pruinose prescutellar patch; median pruinose stripe with an acrostichal series of hairs in two or more rows, this series merging with a group of erect, prominent hairs on anterior surface of hump; lateral pruinose areas without hairs; a large anterolateral group of hairs between callus and anterior end of lateral pruinose stripe, continuing into a narrow, dorsocentral strip of hairs between median and lateral pruinose stripes, these two strips of hair merging on the pruinose pre-scutellar patch, the acrostichal series of hairs stopping before this; also a prominent, extensive supra-alar tuft, and small tuft on upper surface of post-alar callus; supra-alar declivity bare. Scutellum pruinose, frosty greyish tinged with yellow (best seen in oblique view), margined with long hairs. Wing base pale yellowish. Mesono-



TEXT-FIGS. 10-17.

*Nemopalpus capensis*, basal antennal segments (10) and 7th flagellar segment (11); *N. concolor*, basal antennal segments (12), 9th flagellar segment (13), apical segment (14), and discoidal and "spinose" ascoids (15); *N. transvaalensis*, 6th abdominal sternite of ♀ with modified hairs (16), and modified hairs further enlarged (17).

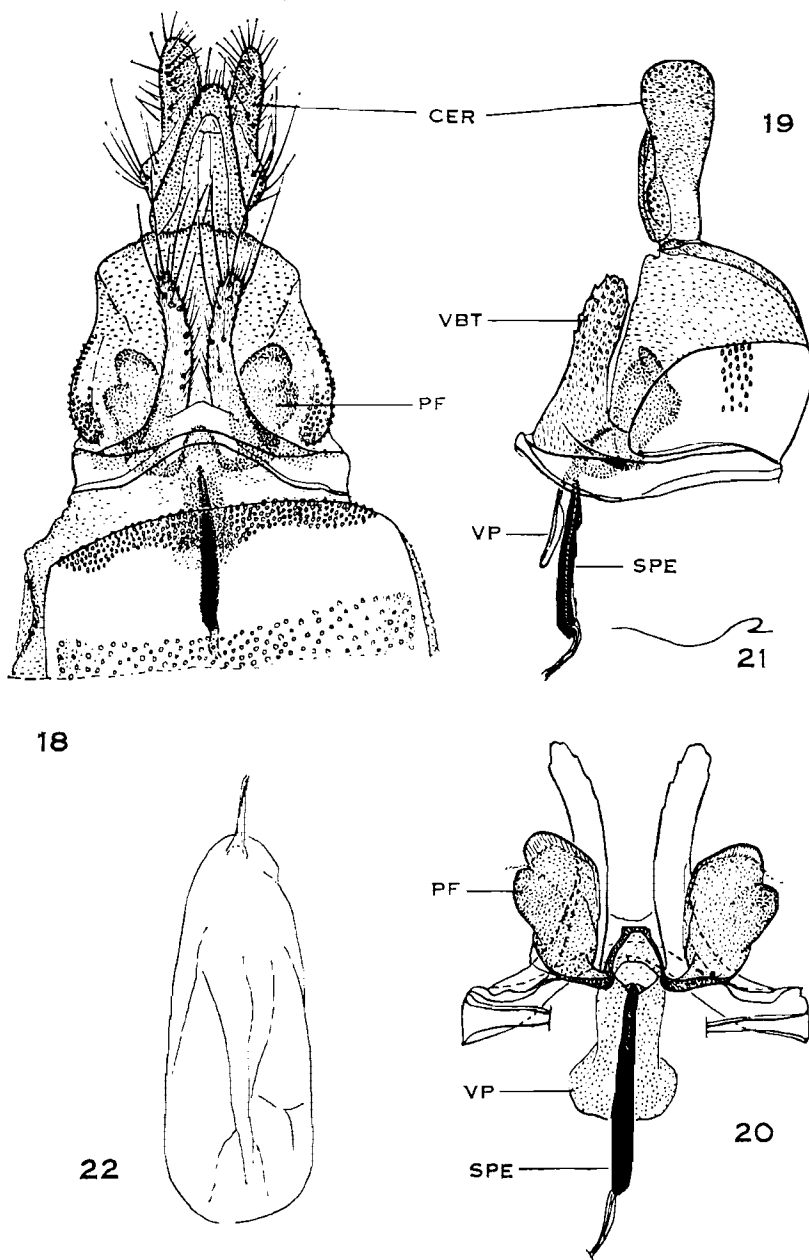
tum almost toffee brown on haired parts where pruinescence is absent. Pleura light yellowish brown, almost clay coloured, in well-preserved specimens an obscure, dark, horizontal mark across sterno- and pteropleura opposite attachment of fore coxa; a slight darkening also on lower part of sternopleuron. Pleura devoid of hairs, except small prespiracular tuft on propleuron. Coxae clear, pale yellowish. Legs densely covered with recumbent, subshining. yellowish-brown hairs, femora with some longer hairs below, tibiae and first two tarsomeres with suberect, yellowish bristles. Haltere dull brownish yellow with short, shining, yellowish hairs.

Wings uniformly and quite thickly haired, hairs dark in transmitted light, shining, slightly pinkish yellow in oblique light. Venation (text-fig. 2) shows complete absence of spurs on radial and median veins, *M*1 and *M*2 forking apicad of *r-m*, fork *R*2 and *R*3 very deep, *R*2 about  $2\frac{1}{2}$  times *R*2 + 3.

Abdomen variable in colour according to drying of contents, light brownish to toffee brown, with abundant, suberect, straw-coloured hair. Tergites and sternites well-sclerotized (much better than in preceding two species), each tergite and sternite with two transverse tracts of hair, a basal and an apical, former twice as wide as latter, space between them hairless (thereby giving a confusing impression of the segmentation). No modified hairs in either sex, nor any special modification of sclerites into pockets and other structures like those described in various species of *Nemopalpus*.

Male genitalia shown in text-figs. 6 and 9, inverted as usual. Ninth tergite much broader than corresponding sternite; aedeagus with fairly broad, rounded apex; dististyle very distinctive, being narrow basally, increasing steadily in width to apex, slightly sinuous, apex truncated and with a crest of eight broadly subtriangular, scale-like teeth (text-fig. 9 inset); inner surface of dististyle with long hairs; a cluster of minute, highly refractive seta sockets near base. Internal aedeagal sclerites shaped as in text-fig. 6, basal apodeme greatly broadened at cephalic end, apical sclerite with slender, curved tip, ratio of lengths of apical and basal sclerites, 1 :  $2\frac{1}{2}$ .

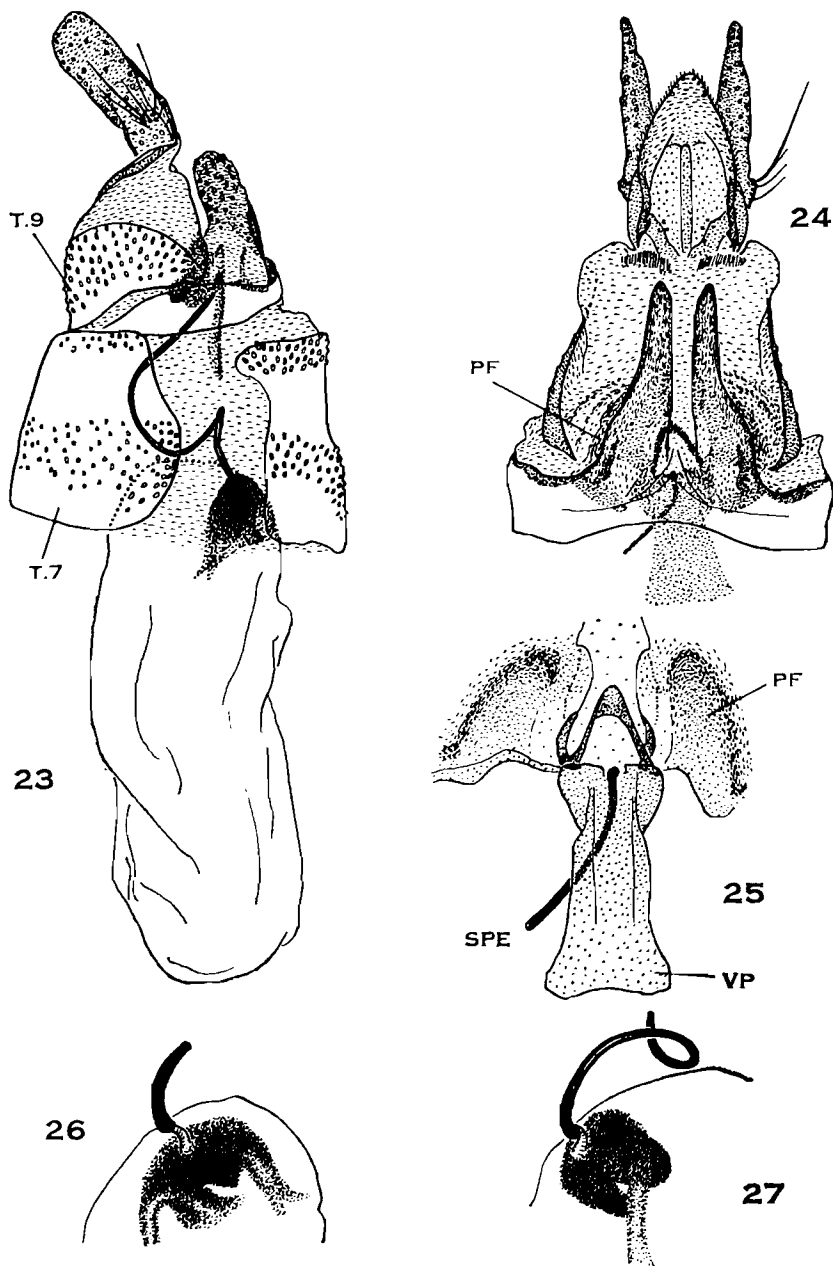
Female genitalia (text-figs. 23–27) essentially as in *capensis*, but many details differing. Eighth tergite and sternite fused into an annular sclerite, very narrow above, which supports below the two lobes of oviscapt; ninth tergite (t.9) complete, large; tenth tergite curving ventrad, divided longitudinally by membranous strip. An extensive membrane forms ventral surface to ninth and tenth tergites; this membrane has basad on each side two folds curved about a shallow, concave depression (text-figs. 24, 25, *pf*) sited above lower part of oviscapt lobe, these depressions visible in lateral view as dark areas (text-fig. 23); depressions are bounded on cephalic margin by sclerotized rim, and separated in mid-line by a V-shaped sclerite (text-fig. 25); attached across ends of arms of this sclerite is a plate-like apodeme shaped as shown in text-fig. 25 (*vp*); this plate has a narrow, median cleft at distal end in which is attached apex of spermathecal duct. Spermatheca (text-fig.



TEXT-FIGS. 18-22.

Female genitalia of *Nemopalpus capensis* (specimen from Kranskop); (18) ventral view; (19) lateral view; (20) dorsal view of oviscapt with eighth tergosternite, over which are situated concavities in ventral membrane (*pf*, stippled, these should be seen as convex towards viewer), the heavily sclerotised apical part of spermathecal duct (*spe*) dorsal to apodeme (*vp*); (21) profile of depression in membrane (*pf*) in median longitudinal section; (22) spermatheca, not to same scale as fig. 18; *cer* indicates the cerci.





TEXT-FIGS. 23-27.

Female genitalia of *Nemopalpus concolor*; (23) lateral view, the large, sac-like spermatheca attached by its dark, coiled duct; (24) ventral view, *pf* being a shallow concavity in membrane above oviscapt; (25) ventral view of sclerites around genital opening, showing concavities in membrane (*pf*) and plate-like apodeme (*vp*) which is ventral to spermathecal duct (*spe*); (26, 27) enclosed spermathecal structure in two different positions—in fig. 27 it has been turned from its position in fig. 26, through a right angle towards the observer, from left to right; *t.9* and *t.7* indicate ninth and seventh tergites respectively.

23) a large, membranous sac; spermathecal duct strongly sclerotized, dark, long, coiled in macerated specimen, entering spermatheca at its pical end, and opening into a peculiar, dark, sclerotized structure of complex, irregular shape, three views of which are shown in text-figs. 23, 26, 27, this structure contained within spermatheca, its several lobes apparently enclosing ducts.

Length of wing: ♂, 4.45–4.9 mm.; ♀, 4.65–5.1 mm.

*Material examined*.—Holotype ♂, allotype, 8 paratopotypes (4 ♂, 4 ♀), from indigenous forest at Port St. Johns, Pondoland, Eastern Cape Province, 16–17.x.1959 (B. R. and P. J. Stuckenberg leg.); in Natal Museum (No. 800), except a pair donated to British Museum (N.H.). The specimens were found resting on shaded, moss-covered trunks of large trees.

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